What radio invented Marconi

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In July 2007 marks the 110th anniversary of the grant of G. Marconi (1874 - 1937) the first patent for the invention of wireless telegraphy. The final execution of the document was preceded by a preliminary application.

The article published in this issue describes the study of the application text and the events surrounding its appearance and expertise.

A. S. Popov started

The author of this article became interested in its topic in 2005, during the period preceding the anniversary — the 110th anniversary of the historic meeting of the Physical Department of the Russian Physicochemical Society (RFHO) in St. Petersburg, and the speeches by A. S. Popov (1859-1906)) with the report "On the relation of metal powders to electric vibrations" and the demonstration of "an instrument designed to show fast vibrations" [1]. I looked and studied many domestic book and magazine publications [2, 3], as well as collections of materials on the Internet. He ascertained the freedom of access to museum and archival documents testifying to the superiority of Popov in the invention of radio. It is appropriate to clarify that the combination of the words "invention of the radio" was not entirely correct but firmly established in Russian and foreign literature, was introduced by the Russian academician A. I.

The author drew attention to individual works [5, 6], which set forth their vision of the primary role of Marconi in the formation and development of telegraphy without wires at the end of the nineteenth century. With great interest I read on the Internet a lot of foreign English-speaking (English and American) articles on the birth of wireless telegraphy. Some of them, for example [7], pay tribute to Popov in conducting the first communication sessions with generators of often repeated pulse signals, but nevertheless they do not agree with his priority with respect to Marconi.

In the overwhelming majority of materials (non-calculus) it is even stated that Marconi began conducting experiments on the transmission and reception of electromagnetic disturbances in 1894, that is, a year earlier than the public speech of Popov at a well-known meeting of the RFHO, veiled prompts that it was then and the radio was invented.

Let's see the docs

Everything investigated seemed to the author extremely interesting. Naturally, I wanted to look at the documents, it was decided to look at them. And then it turned out that everything concerning Popov was true, there were official papers. What about Marconi? There are no documents confirming at least some work on wireless telegraphy, performed by him in 1894-1895. One cannot take seriously, for example, the memoirs of a gardener of the Marconi family who did not know the letter, retold in writing by his son, or the daughter of Marconi, born in 1908

Marconi himself, in response to the presentation of the Nobel Prize in Physics in 1909, stated that "he never regularly studied physics and electrical engineering. At his home in Italy, near Bologna (on the family estate), he began to conduct research and experiments on the wireless transmission of telegraph signs and symbols through the Hertz waves only at the beginning of 1895. " However, this statement cannot serve as a factual confirmation. At that time, Marconi was only 21 years old and he did not even have a secondary technical education.

The first known document of Marconi's appeal to wireless telegraphy appeared only on June 2, 1896 (13 months after the official speech of Popov at the RFHO!). This was the legendary provisional application (P3) for an invention (patent) to the British Patent Office (BPB) under No. 12039 [8]. Historians of inventions know many cases of simultaneous research in distant countries, and a difference of 13 months is considered significant.

Thus, Alexander Ball (1847-1922) was recognized as the inventor of the telephone, although he filed his application in 1876 only two hours earlier than the rival E. Gray (1835-1901). Here - 13 months! However, foreign popularizers of the early history of wireless communications still agree that the fundamental technical solution for wireless telegraphy, the scheme of the transmitting and receiving equipment were shown by Marconi in PP No. 12039, and not by Popov at the historic RFHO meeting.

Over the past 100 years, tens of thousands of text and illustration pages have been written in defense of the priority of the British invention. The humor, farce and tragedy of the situation are that none of the authors applying for Marconi have ever even seen the full text of PP No. 12039. The author of the article was convinced of this when he decided to get to know her — she was nowhere to be found. It was never published in the open press; copies were not taken from it for museums, public archives, etc.

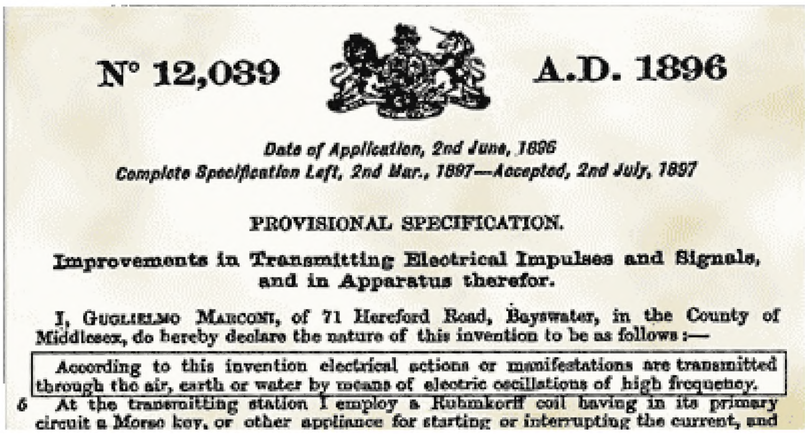
Then the author decided to make a request to the BPB. An amazing message came from there - "the preliminary application for No. 12039 is not stored in the annals of the patent office, it was destroyed in due time and unnecessarily."

After repeated written appeals and telephone conversations, it was still possible to trace the life path of this PP. A short time after the filing, a positive decision and the subsequent grant of a patent on it, it was withdrawn from the BPB and deposited with the Marconi Corporation (MARCONI CORPORATION).

Marconi phenomenon

In 2004, MARCONI CORPORATION declassified the Marconi collection. Samples of the equipment were transferred to the Museum of the History of Science of the English University of Oxford, written documents were transferred to the library of the educational institution. Now anyone can read the first page of PP No. 12039 on the Internet [9]. The author managed to get the full text of this PP (for a tangible amount of money).

The document includes two sheets of standard size (A4 format), written in print on one side, and an envelope where they are placed. The biggest "revelation" of the document was that it does not contain illustrative material. The applicant did not place diagrams, diagrams or device drawings in it. The question is, what superiority, for example, of the Marconi wireless telegraph receiver, can we talk about if even after 13 months after Popov's speech at the RFHO, the Marconi receiver circuit has not been made public?



N° 12,039 **A.D. 1896**

Date of Application, 2nd June, 1896
Complete Specification Left, 2nd Mar., 1897—Accepted, 2nd July, 1897

PROVISIONAL SPECIFICATION.

Improvements in Transmitting Electrical Impulses and Signals, and in Apparatus therefor.

I, GUGLIELMO MARCONI, of 71 Hereford Road, Bayswater, in the County of Middlesex, do hereby declare the nature of this invention to be as follows:—

According to this invention electrical actions or manifestations are transmitted through the air, earth or water by means of electric oscillations of high frequency.

At the transmitting station I employ a Ruhmkorff coil having in its primary circuit a Morse key, or other appliance for starting or interrupting the current, and

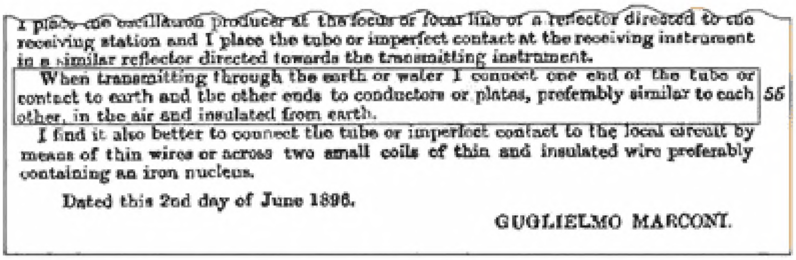
fig. 1. A fragment of the title page of a preliminary application for an invention filed by G. Marconi with the British Patent Office on June 2, 1896.

The name of the invention proposed for examination is "Improvements in the transmission of electrical pulses and signals and in the equipment for this." A great number of popularizers of Marconi's work enthusiastically accepted the text of this title. However, the term "improvement" is immediately alarming; it follows from it that the author does not propose anything new, but only improvements to something already known. The enumeration of "improvements" begins immediately in the first paragraph of the title page (a fragment of it is shown in Fig. 1) after the presentation of the formal information about the author: "The electrical actions or manifestations corresponding to this invention are transmitted through air, earth, water through high-frequency electric oscillations" (phrase is framed by the author).

Having placed this statement in an official document, the applicant "made a big mistake". The aforesaid means that by the time the application was submitted, the applicant for the invention of the radio was not familiar with the previously performed theoretical and practical works of G. Hertz (1857 - 1994) and N. Tesla (1856 - 1943) and he himself did not carry out practical experimental work. If he had conducted them, he quickly became convinced that high-frequency electrical vibrations (electromagnetic vibrations - EMC) do not pass through the earth and water.

Other major "improvements" include suggestions: to make the glass detector tube with metal filings airtight, as well as using the Popov method already known to him then to automatically shake the tube after passing a useful signal through the detector. It is proposed to attach metal plates of "suitable length to both ends of the tube to cause electrical resonance in unison with the electrical vibrations of the transmitter".

It should be noted that in the PP there are no explanations on the external EMC trap, the term "antenna" is missing. By "suitable length" plates, most likely is meant a planar antenna known from Hertz's experiments. It must also be admitted that the PP, in addition to a very limited technical description, "sins" a very illogical presentation of the material, which is difficult to comprehend even taking into account the polysemy of many English words. It is more like a set of abstracts or a statement of intent.



I place the oscillation producer at the focus or focal line of a reflector directed to the receiving station and I place the tube or imperfect contact at the receiving instrument in a similar reflector directed towards the transmitting instrument.

When transmitting through the earth or water I connect one end of the tube or contact to earth and the other ends to conductors or plates, preferably similar to each other, in the air and insulated from earth.

I find it also better to connect the tube or imperfect contact to the local circuit by means of thin wires or across two small coils of thin and insulated wire preferably containing an iron nucleus.

Dated this 2nd day of June 1896.

GUGLIELMO MARCONI.

fig. 5. Fragment of a preliminary application for an invention filed by G. Marconi

The ridiculous and unfounded statement formulated at the beginning is repeated again at the end of the text presented in Fig. 5. The penultimate paragraph (also highlighted in a box) says that it has not been tested practically and that in reality does not exist: "When the transmissions go through land or water, I attach one end of the tube or contact (from the author - the detector is meant) to the ground, and the other ends to preferably conductors or plates of air similar to each other, isolated from the earth. "

Popov's invention arrived in England

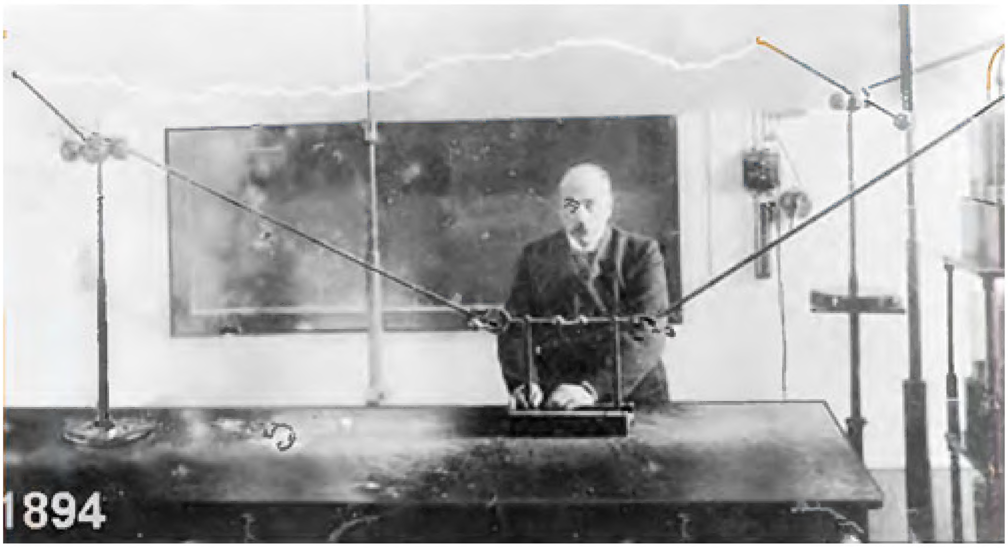


Fig. 6. Famous Italian physicist Professor A. Riga

"Device for the detection and registration of electrical vibrations" Popov in 1896 with all the details was presented in the January issue of RFHO [10], which had a European mailing list. In the same month, the journal entered the library of the University of the Italian city of Bologna (it is still stored there), where the famous Italian physicist Professor A. Riga (1850-1920), shown in fig. 6. Occupations of Riga just visited the listener Marconi.

Fig. 7. The chief engineer of the telegraph of Great Britain V. Price

In February 1896 Marconi, having a “secret” scheme and a box with parts, left for London, where he was introduced through kindred channels to the aristocrat of blue blood, the chief engineer of the telegraph of Great Britain, W. Price (1834 - 1913), shown in Fig. 7. With his perseverance, determination and business acumen, Marconi made the most favorable impression on Pris.

Beginning in February 1896 Pris contributed to the technical verification and refinement of the receiving and transmitting equipment, helped Marconi to compile the first application in his life. According to the text of the PP, certain rationalization “telegraph” proposals “appear”, for example, on spark suppression of relay contacts by shunt resistors, etc. However, as already mentioned, not everything turned out smoothly.

Pryce was in good scientific, technical and friendly relations with the famous English physicist O.D. Lodge (1851 - 1940). The famous German physicist G. Hertz's work carried out in the 1880s experimentally proved the propagation of EMC in empty space at the speed of light. After that, Logem showed the propagation of EMC in conductors and also at the same speed.

It should be noted that Pris and Lodge belonged to the characteristic type of science of educated and highly erudite leaders, but not sufficiently capable of technical development and implementation of theoretical ideas in practice [11]. It is also interesting to recall that O. D. Lodge was addicted to spiritualism and, at the age of eighty, promised to transmit a message from the other world after death. Before passing away, he wrote the text of this message and left it for preservation in order to be able to compare it with the received radiogram. Nobody has managed to convey such greetings yet, O. D. Lodge also remains silent for now.

The Lodge did not fully verify its thoughts on the passage of EMC through conductors and other physical media. It can be assumed that both he and Pris believed that if EMCs, like electric current, “run” along metal wires with the same speed, then EMCs will also run in other environments, including in the thickness of the earth and water. PMS hoped to use EMC through land and water for communication with coal mines and submarines. Quite possibly, that is why, on the recommendation of Pris, Marconi wrote in the first paragraph of the PP presented an erroneous provision on the ability of EMC to penetrate through land and water and repeated in the end.

Along the way, it should be noted that by the time Marconi was composing the application by Lodge for the glass tube-detector with metal filings, the term “coherer” was coined, which was later established. However, for reasons of patent purity and likely claims of the Lodge, this term was not used by Marconi by order of Pries.

Progress towards success

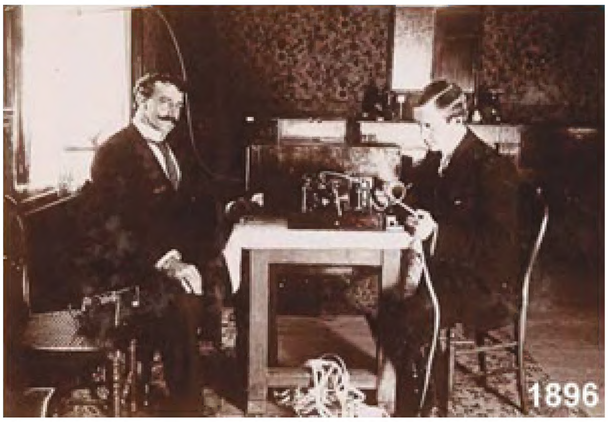


Fig. 2. G. Marconi (right) and his assistant J. Kemp when testing the receiving apparatus for telegraphy without wires.

In his autobiography, Marconi reports that Pris has repeatedly observed the inclusion and testing of his transmitting and receiving devices in the premises of the technical service of the telegraph department. In July 1896, he asked for a demonstration of the equipment in front of senior officials of the London branch of the organization. The transmission and reception of pulsed signals were shown in buildings 400 m apart. At the same time, Pris ordered the assistant, a highly qualified telegraph engineer J. Kemp (1858–1933), to be attached to Marconi. He became the lifetime assistant and director of a number of works at Marconi. Both of them can be seen in fig. 2 (Marconi on the right).

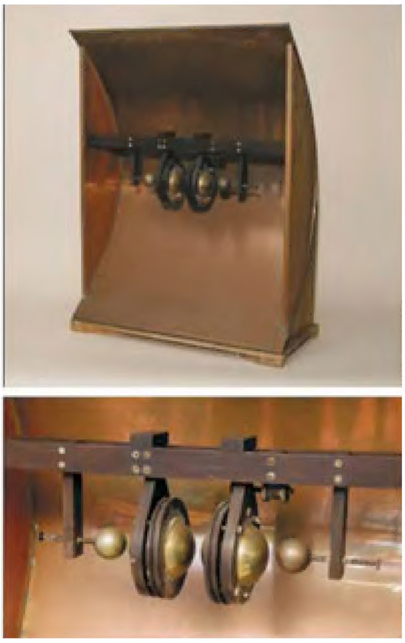


Fig. 3 transmit antenna with parabolic reflector

It was decided to invite representatives of the army and navy to see the new communications technology. The tests took place on September 2, 1896. in the town of Salisbury near London (130 km to the south) with a large audience. It is known that the transmitter consisted of a self-induction EMF coil of G. Rumkorf (1803 - 1877) connected to a spark gap similar to that developed by Riga in Bologna. Several modifications of the devices were shown: transmitting devices with antennas from a long wire and in the form of a parabolic reflector, shown in Fig. 3 and having dimensions 61 (width) x 81 (height) x 30 (depth) cm; Receivers with a printing mechanism (PM), as in Fig. 8, and antennas in the form of a long wire and a parabolic reflector 61 x81 x30 cm, but without PM, as in Fig. 9. None of the receivers used flat metal plates specified in the text of the PP, attached to the detector tube. Receiver circuits were not disclosed.

The test results disappointed the military. With a three-meter outdoor antenna, the receivers could catch signals at a distance of less than 0.5 km, which was not satisfied with potential customers. The transmitter and receiver with parabolic reflectors showed a range of 2.5 km, but the representatives of the fleet were not satisfied either, since the reflectors required orientation on each other, which is almost impossible to provide on a sailing vessel. For this reason, in the future, reflex antennas were used only on land for stationary objects.

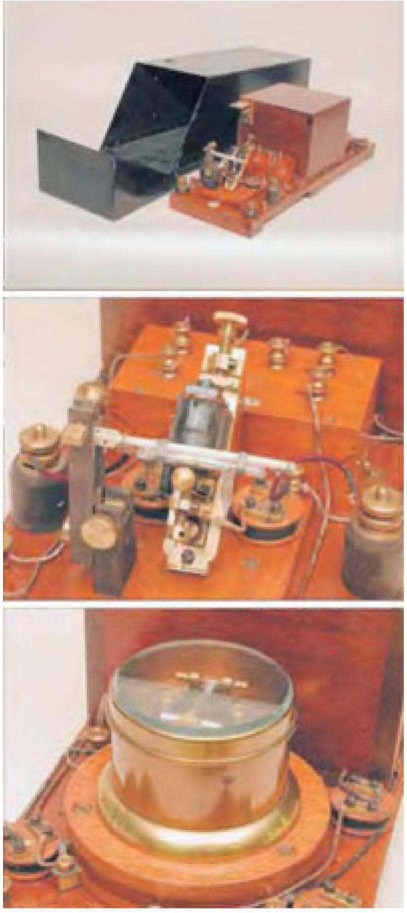


Fig. 8 Receivers with a printing mechanism

The next meeting with the military took place in March 1897, also in Salisbury. The incident there became known to the correspondents of some newspapers, who called the event "attraction". The receiver antenna, 40 m long, was raised to a height by a gas cylinder ("mini-balloon"). However, the reception range still did not exceed 5 km. Transceivers with reflectors were not involved in the tests. The military again did not believe in the practical feasibility of operating equipment of a new type of communication.

Kemp's diary, which he began to conduct in July 1896, records that, on

Fig. 4 Radio telegraph receiver with a call registering them

the proposal of Price on December 12, 1896, in the conference room (Toynbee Hall) of the London Philanthropic Educational Institute, located in the eastern part of the city, the first official public presentation of wireless telegraphy took place. Few representatives of the scientific intelligentsia and the press, who are interested in modern achievements, saw the closed black boxes with which Pryz paced on the stage and Marconi in the hall. When Pris pressed the telegraph key, Marconi rang the bell located at the top of the building, which is visible in Fig. 4, the demonstrations made a strong impression. The audience liked the manner of behavior of Marconi. The next day, laudable articles appeared in newspapers, first mentioned by Marconi in the general press.

In all the first demonstrations of wireless transmitting and receiving equipment, Pris spoke with lectures and explanations. No reports were made about the filed patent application and its ongoing examination by Pris on behalf of the BPB. Marconi seemed to be present only as a promising assistant, tacitly following the orders of Pries.

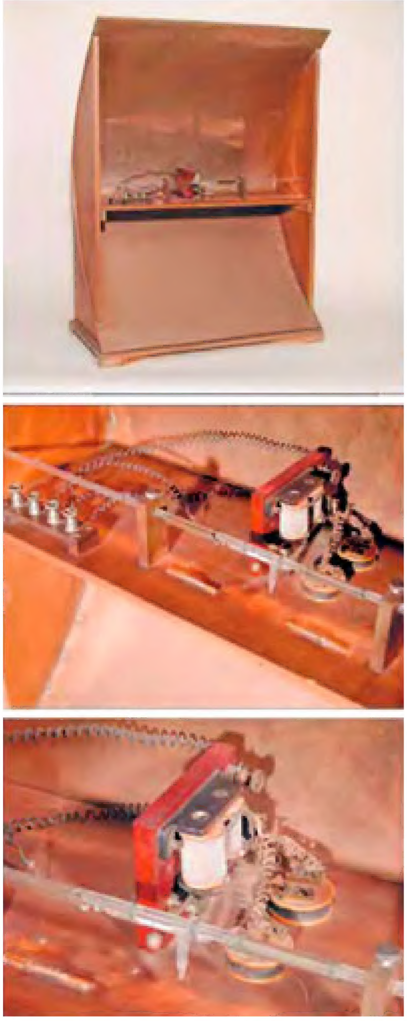


Fig. 9 Receivers with antennas in the form of a long wire and a parabolic reflector, but without PM

After the fact

From the foregoing, we can conclude by repeating that in PP No. 12039 no diagrams and drawings of equipment are given, the text part “sins” with absurdity, rare for this kind of official descriptions, does not contain a coherent and understandable presentation of the operation of the receiver, around the circuit and design of which in fact, there has been debate for more than 100 years. At all communication sessions conducted by Pris and Marconi in 1896, the essence of the invention was not disclosed, and device schemes were also not seen by anyone. However, there were some specific transmitters and receivers. It is possible that those of the "Marconi collection", dated 1896, are now stored in the Museum of Oxford University. But this should not be completely trusted. They are not supplied with documents showing their binding to 1896, and are more similar to devices made in subsequent years.

Based on the foregoing, it can be judged that 20 months after Popov’s speech at the RFHO meeting, Pris and Marconi did not yet have “the invention of the radio”.

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Continuing the theme: Merkulov V. When and by whom was the radio invented

The article was published in the journal Radio.
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The article was placed in the museum on 10/10/2007